DESIGN OF AFA HOTEL 8 STORIES WITH STEEL CONSTRUCTION IN SURAKARTA

Final Project

In partial fulfillment for the award of
Bachelor of Engineering Degree in Civil Engineering

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CERTIFICATION SHEET

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On 11th July 2015

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Declare that this Final Project is made and presented by mine, except the quotations and summaries that I have explained from all of the sources. If at a later it is found that this Final Project is a product of plagiarism, I am willing to accept any legal consequences that may be imposed to me.

Surakarta, 11th July 2015

Person responsible,

Dwi Prasetyo Utomo

MOTTO

"The only way to have the greatest work in your life
is love what you do first"
(Anonim)

"And whenever you give your word, say the truth"
(al-An`aam 6:152)

"You are creator for your own future "
(Anonim)

"Idza shodaqol 'azmu wadhohas sabil"
(Mahfudzot)

"Do your own thingking independently
Be the chess player, not the chess piece"
(Anonim)

"Make up one idea. Make that idea on your life
– think of it, dream of it, live on that idea.
Let the brain, muscles, nerves, every part
of your body, be full of that idea,

and just leave every other idea alone.
This is the way to success.
(Swami Vivekananda)

PREFACE

Assalamu'alaikum Wr. Wb.

Alhamdulillah, all praise to Allah azza wa jalla who has given blessing and mercies until this Final Project can be completed. This Final Project to complete most the requirement to achieve S-1 graduate degree in Civil Engineering Department, Engineering Faculty, Universitas Muhammadiyah Surakarta. The author also says thanks for all parties who give any support for arrangement this Final Project until it can be completed.

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The author realize that the arrangement this Final Project is not a perfect one. Because of that, the author hope there are any suggestion and criticism to make this Final Project better and can be useful for us. Aminnn

Wassalamu`alaikum Wr.Wb.

Surakarta, 11th July 2015

Author

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a	=	depth of compressive block, mm
A_{BM}	=	cross-sectional area of the base metal, mm^2
A_{gv}	=	gross area subject to shear, mm^2
A_{nt}	=	net area subject to tension, mm^2
A_{nv}	=	net area subject to shear, mm^2
A_{sa}	=	cross-sectional area of steel headed stud anchor, mm^2
A_x	=	torsional amplification factor
A_w	=	area of the web, mm^2
A_{we}	=	effective area of the weld, mm^2
b	=	length of an RBS cut, mm
b_{bf}	=	width of beam flange, mm
$b_{f,RBS}$	=	width of RBS beam flange, mm
B_1	=	multiplier to account for P-δ effects
B_2	=	multiplier to account for P-Δ effects
c	=	depth of cut at center of the reduced beam section, mm
C_d	=	the deflection amplification factor
C_m	=	coefficient assuming no lateral translation of the frame
C_s	=	The seismic response coefficient
C_t	=	Values of approximate period parameters
C_u	=	the coefficient for upper limit on calculated period
C_v	=	Web shear coefficient
C_{vx}	=	vertical distribution factor
d	=	overall depth of the beam, mm
D	=	dead load, kN
e	=	equivalent eccentricity, mm
e_{crit}	=	critical eccentricity, mm
E	=	earthquake load, kN
E_c	=	modulus of elasticity of concrete, Mpa
F_a	=	short-period site coefficient
F_v	=	long-period site coefficient
F_{cr}	=	Critical stress, Mpa
F_e	=	elastic buckling stress, Mpa
F_{nBM}	=	nominal stress of the base metal, Mpa
F_{nv}	=	nominal shear strength, Mpa
F_{nw}	=	nominal stress of the weld metal, Mpa
FS	=	factor of safety
F_u	=	specified minimum tensile strength, Mpa
F_x	=	lateral seismic force, kN
$f_{p(max)}$	=	maximum concrete bearing stress, Mpa
h	=	high of web, mm
h_i, h_x	=	the height from the base to level i or x, m
H_r	=	nominal rib height, mm
h_{sx}	=	the story height below level x, m
I	=	moment of inertia, cm^4
I_e	=	Seismic importance factor
k	=	distribution exponent
K	=	The effective length factor
k_v	=	the web plate shear buckling coefficient

L = live load, kN
L_b = distance between braces, mm
l_e = Bolt edge-distance, mm
L_h = distance between plastic hinges, mm
L_p = Limiting laterally unbraced length for the limit state of yielding, mm
L_r = Limiting laterally unbraced length for the limit state of inelastic lateral-torsional buckling, mm
M_c = available flexural strength, N-mm
M_{CER} = Risk-adjusted maximum considered earthquake
M_f = moment at the face of the column, N-mm
M_{lt} = first-order moment using LRFD, due to lateral translation of the structure only
M_n = Nominal moment, N-mm
M_{nt} = first-order moment using LRFD, with the structure restrained against lateral translation, N-mm
M_{pe} = expected plastic moment of the beam, N-mm
M_{pr} = probable plastic moment at the center of the reduced beam section, N-mm
M_r = required flexural strength, N-mm
M_u = required moment strength, N-mm
M_x = moment in the X direction, N-mm
M_y = moment in the Y direction, N-mm
n = number of bolt
N_i = notional load applied at level i, kN
n_1 = number of pile in row
n_2 = number of pile in column
N_{60} = the average value of the standard penetration number near the pile point (about 10D above and 4D below the pile point)
P_a = atmospheric pressure, kN/m^2
P_c = axial strength design, kN
P_{lt} = first-order axial force using LRFD, due to lateral translation of the structure only, kN
P_n = nominal compressive strength, kN
P_{nt} = first-order axial force using LRFD, with the structure restrained against lateral translation, kN
P_{max} = equivalent of vertical load for pile, kN
P_{mf} = total vertical load in columns in the story that are part of moment frames,if any, in the direction of translation being considered, kN
P_r = required axial strength, kN
P_{rb} = required strength of nodal lateral bracing away from an ecpected plastic hinge location, kN
P_{story} = total vertical load supported by the story, kN
P_x = the total vertical design load at and above Level x, kN
$P_{e\ story}$ = elastic critical buckling strength for the story in the direction of translation being considered, kN
Q_{all} = allowable load-carrying capacity for each pile, kN
Q_n = shear capacity of a single stud, kN
Q_p = point bearing capacity, kN
Q_s = friction resistance (skin friction) derived from the soil-pile interface, kN
Q_u = ultimate load-carrying capacity, kN
r = radius of gyration, mm
R = The appropriate response modification coefficient
R = RBS radius of cut, mm

S	=	Spacing between bolt, mm
S_1	=	Pile edge-distance, mm
S_{d1}	=	The design spectral response acceleration at 1 second period
S_{dS}	=	The design spectral response acceleration at short period
S_h	=	distance from face of the column to the plastic hinge, mm
S_{MS}	=	The mapped M_{CER} spectral response acceleration parameter for short periods
S_{M1}	=	The mapped M_{CER} spectral response acceleration parameter for 1 s periods
S_1	=	the mapped M_{CER} spectral response acceleration parameter at a period of 1 s
S_S	=	The mapped M_{CER} spectral response acceleration parameter at short periods
T	=	the fundamental period of the structure, s
t_{cf}	=	thickness column flange, mm
T_L	=	long-period transition period, s
$t_{p(req)}$	=	minimum plate thickness, mm
t_w	=	thickness of web, mm
V_{RBS}	=	shear forces at RBS, kN
V_s	=	The seismic base shear, kN
V_u	=	required shear strength, kN
V_x	=	the seismic shear force acting between Levels x and x – 1, kN
W	=	the effective seismic weight, kN
w_i, w_x	=	the portion of the total effective seismic weight (W) located, kN
W_r	=	average width of concrete rib, mm
x	=	subscript relating symbol to strong axis bending, mm
X_{max}	=	the longest distance of pile in X direction, mm
Σx^2	=	total of absis quadratic X each pile based neutral line of group pile, mm
y	=	subscript relating symbol to weak axis bending, mm
Y_{max}	=	the longest distance of pile in Y direction, mm
Y	=	the bearing length, mm
Y_i	=	gravity load applied at level i, kN
Σy^2	=	total of absis quadratic Y each pile based neutral line of group pile
Z_{RBS}	=	plastic section modulus at center of the reduced beam section, cm^3
Z_x	=	plastic section modulus about the x-axis, for full beam cross section, cm^3
Ω_o	=	overstrength factor
δ_{xe}	=	the deflection at the location required determined by an elastic analysis
Δ	=	the design story drift occurring simultaneously with V_x
β	=	the ratio of shear demand to shear capacity for the story between levels x and x–1
β_{br}	=	minimum stiffness for lateral bracing
θ	=	stability coefficient
ρ	=	a redundancy factor
η	=	pile group efficiency
λ	=	width-to-thickness ratio
λp	=	upper limit for compact category
λr	=	upper limit for non-compact category
ϕ	=	resistance factor
ϕ_b	=	resistance factor for bending
ϕ_v	=	resistance factor for shear

ABSTRACT

Surakarta is a town of tourism in Indonesia. The tourists who come to the city of Surakarta, need a place to stay in order to enjoy the beauty of Javanese culture and historic places in Surakarta. The hotel is a building that is used for the residence for tourists. This final project will be to design the hotel AFA 8 stories in Surakarta with steel construction. In the analysis using direct analysis method. This method is a new method in planning of steel structure. Special moment frame (SMF) are system choose, because special moment frame is a common seismic lateral force resisting system use in steel structure. The special moment frame is the best system in building because the beam can develop the seismic force in the plastic hinge. The reduction beam section (RBS) is the best connection in the special moment frame because the plastic hinge occur in the expected point of beam. This final project explains the design special moment frame and details the seismic specification used in design.. The standard code use for design building are American Standard Codes (ASCE, AISC and ACI). Analysis structure in the design calculation use software ETABS 2015. The pile foundation will use in the building to support the load from column and then transfer it to stiffness soil with 11 m in depth. The result in design dimension of SMF column W_{14x370}, SMF beam W_{21x132}, Non-SMF column W_{14x257}, and Non-SMF beam W_{21x68} are satisfied to use in the building. Dimension base plate 80 cm x 75 cm x 5 cm is satisfied. The pile foundation with 30 cm x 30 cm diameter are satisfied to resist the load. Sloof use dimension 30 cm x 50 cm. Longitudinal reinforcement use 8D16 and shear reinforcement Φ10-200 mm.

Key words: Surakarta, special moment frame, reduction beam section, hotel.